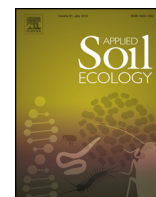




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Labile carbon and nitrogen additions affect soil organic matter decomposition more strongly than temperature



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ABSTRACT

Inputs of labile carbon (C) and nitrogen (N) affect the intensity and direction of priming effects (i.e., increase or decrease of soil organic matter (SOM) decomposition caused by labile inputs). Increased temperature is also an important factor affecting SOM decomposition. However, the effects of temperature on priming of SOM decomposition remain unclear. To investigate how temperature affects priming of SOM decomposition through changing microbial composition, we added ¹³C-labeled glucose with or without NO₃[−] or NH₄⁺ to a subtropical plantation soil in southern China and incubated the soil at 15 °C and 25 °C for 10 days. Soil microbial composition was assessed by analysis of phospholipid fatty acids (PLFAs). Glucose led to positive priming (release of additional CO₂) at both temperatures. In contrast, glucose addition with NO₃[−] or NH₄⁺ resulted in negative priming. Temperature did not show a significant effect on SOM decomposition, while the effects of temperature on priming of SOM decomposition were dependent on labile C and N. Labile C addition induced stronger priming at 25 °C than at 15 °C, while combined C and N addition more strongly reduced priming at the high than the low temperature. Although PLFA composition was affected by temperature and labile C and N inputs, changes in PLFA composition were not correlated with priming. We conclude that temperature changes may have limited effects on SOM decomposition in this subtropical soil, while the availability of labile organics has a much stronger effect on priming under warming.

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1. Introduction

Soil organic matter (SOM) contains the largest amount of carbon (C) in terrestrial ecosystems (German et al., 2011), almost four times higher than that in the atmosphere (Tarnocai et al., 2009). Even small changes in this soil C pool could significantly affect atmospheric CO₂ concentration, leading to positive feedbacks on climate change (Raich and Potter, 1995; Schlesinger and Lichter, 2001). Therefore, investigating the factors affecting SOM dynamics is a prerequisite for better understanding climate-carbon cycle feedbacks (Sun et al., 2014).

Temperature is an important factor affecting SOM dynamics. Increased temperature substantially accelerates SOM decomposition (Kirschbaum, 2006; Conant et al., 2011; Razavi et al., 2015), thus potentially contributing to global warming. Therefore, many studies have examined temperature sensitivity of SOM decomposition in the alpine, boreal, and temperate ecosystems (Lu et al., 2013), where the most dramatic increases in temperature have been predicted. Although greater understanding has been achieved, the results from various studies regarding the temperature sensitivity of SOM decomposition remain controversial (Giardina and Ryan, 2000; Fang et al., 2005; Bradford, 2013). Although a temperature increase is also expected in subtropical forests (Liski et al., 2003; Tan et al., 2012; Dai et al., 2016), few studies have explored the effects of warming on SOM decomposition (Wu et al., 2016).

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